

## CLAIMS

1. An apparatus for collecting and redistributing a flow of a liquid descending in an exchange column having a longitudinal axis, a cross-sectional area, and an inner wall having an inner perimeter, the exchange column containing at least one layer of structured packing having an exterior surface spaced apart from the inner perimeter of the inner wall, comprising:

5 a wall-flow collector disposed in the exchange column above the layer of structured packing, the wall-flow collector having an outer perimeter adjacent the inner perimeter of the inner wall and being adapted to collect at least a portion of the liquid descending on or near the inner wall of the exchange column;

10 a transmission means disposed in the exchange column for transmitting at least a portion of the collected liquid collected by the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column; and

15 a dispensing means for dispensing at least a portion of the portion of the collected liquid from the transmission means to the layer of structured packing.

20 2. An apparatus as in claim 1, wherein the transmission means comprises at least one trough in fluid communication with the wall-flow collector, the trough extending across at least a portion of the cross-sectional area of the exchange column, and the dispensing means comprises at least one aperture or overflow notch in each trough.

25 3. An apparatus as in claim 2, further comprising at least one wiper adjacent the inner wall of the exchange column or the exterior surface of the structured packing, the wiper being located above the trough and adapted to transfer at least a portion of the liquid descending on or near the inner wall into the trough.

30 4. An apparatus as in claim 1, wherein the transmission means comprises a plate, at least a portion of the plate being in fluid communication with the wall-flow collector, the plate

extending across at least a portion of the cross-sectional area of the exchange column, and

the dispensing means comprises at least one aperture in the plate.

5                   5.       An apparatus as in claim 1, wherein  
the transmission means comprises at least one extended wiper  
attached to the wall-flow collector, the extended wiper penetrating across  
at least a portion of the cross-sectional area of the column toward the  
longitudinal axis.

10                   6.       An apparatus as in claim 1, wherein the wall-flow collector is  
fixedly attached to the inner wall of the exchange column.

15                   7.       An apparatus as in claim 1, wherein the wall-flow collector is  
moveable in a vertical direction along the longitudinal axis within the exchange column.

20                   8.       An apparatus for collecting and redistributing a flow of a liquid  
descending in an exchange column having a longitudinal axis, a cross-sectional area,  
and an inner wall having an inner perimeter, the exchange column containing a first layer  
of structured packing and a second layer of structured packing above the first layer of  
structured packing, each of the first and second layers of structured packing having an  
exterior surface spaced apart from the inner wall, comprising:

25                   a wall-flow collector disposed in the exchange column above the  
first layer of structured packing and below the second layer of structured  
packing, the wall-flow collector adapted to collect at least a portion of the  
liquid descending on or near the inner wall of the exchange column; and

30                   at least one member disposed in the exchange column between  
the first layer of structured packing and the second layer of structured  
packing, each member adapted to support at least a portion of the second  
layer of structured packing and to transmit at least a portion of the  
collected liquid collected by the wall-flow collector toward the longitudinal  
axis a substantial distance across the cross-sectional area of the  
exchange column.

9. An apparatus as in claim 8, further comprising:  
at least one aperture in each member for dispensing at least a  
portion of the collected liquid from the member to the layer of structured  
packing.

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10. An apparatus as in claim 8, wherein the member is a beam having  
a first end, a second end opposite the first end, and an elongated channel between the  
first end and the second end, the elongated channel being in fluid communication with  
the wall-flow collector.

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11. An apparatus for collecting and redistributing a flow of a liquid  
descending in an exchange column having a longitudinal axis, a cross-sectional area,  
and an inner wall having an inner perimeter, the exchange column containing a first layer  
of structured packing and a second layer of structured packing above the first layer of  
structured packing, each of the first and second layers of structured packing having an  
exterior surface spaced apart from the inner wall, comprising:

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a wall-flow collector disposed in the exchange column above the  
first layer of structured packing and below the second layer of structured  
packing, the wall-flow collector being fixedly attached to the inner wall and  
adapted to collect at least a portion of the liquid descending on or near the  
inner wall of the exchange column;

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at least one beam disposed in the exchange column between the  
first layer of structured packing and the second layer of structured  
packing, each beam adapted to support at least a portion of the second  
layer of structured packing and each beam having a first end, a second  
end opposite the first end, and an elongated channel, having an open top  
and a floor, between the first end and the second end, the elongated  
channel being in fluid communication with the wall-flow collector and  
adapted to transmit at least a portion of the collected liquid collected by  
the wall-flow collector toward the longitudinal axis a substantial distance  
across the cross-sectional area of the exchange column;

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at least one aperture in the floor of the channel of each beam for  
dispensing at least a portion of the collected liquid from the channel of the  
beam to the layer of structured packing; and

at least one wiper adjacent the inner wall of the exchange column or the exterior surface of the structured packing, the wiper being located above the beam and adapted to transfer at least a portion of the liquid descending on or near the inner wall into the channel of the beam.

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12. An apparatus for collecting and redistributing a flow of a liquid descending in an exchange column having a longitudinal axis, a cross-sectional area, and an inner wall having an inner perimeter, the exchange column containing a first layer of structured packing and a second layer of structured packing above the first layer of structured packing, each of the first and second layers of structured packing having an exterior surface spaced apart from the inner wall, comprising:

a wall-flow collector disposed in the exchange column above the first layer of structured packing and below the second layer of structured packing, the wall-flow collector being movable in a vertical direction along the longitudinal axis within the exchange column and adapted to collect at least a portion of the liquid descending on or near the inner wall of the exchange column;

at least one beam disposed in the exchange column between the first layer of structured packing and the second layer of structured packing, each beam adapted to support at least a portion of the second layer of structured packing and each beam having a first end, a second end opposite the first end, and an elongated channel, having an open top and a floor, between the first end and the second end, the elongated channel being in fluid communication with the wall-flow collector and adapted to transmit at least a portion of the collected liquid collected by the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column;

at least one aperture in the floor of the channel of each beam for dispensing at least a portion of the collected liquid from the channel of the beam to the layer of structured packing; and

at least one wiper adjacent the inner wall of the exchange column or the exterior surface of the structured packing, the wiper being located above the beam and adapted to transfer at least a portion of the liquid descending on or near the inner wall into the channel of the beam.

13. An exchange column for exchanging heat and/or mass between a vapor and a liquid descending in the exchange column having a longitudinal axis, a cross-sectional area, and an inner wall having an inner perimeter, the exchange column  
5 containing a group of internals, comprising:

at least one layer of structured packing having an exterior surface spaced apart from the inner perimeter of the inner wall;

10 a wall-flow collector above the layer of structured packing, the wall-flow collector having an outer perimeter adjacent the inner perimeter of the inner wall and being adapted to collect at least a portion of the liquid descending on or near the inner wall of the exchange column;

15 a transmission means for transmitting at least a portion of the collected liquid by the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column; and

a dispensing means for dispensing at least a portion of the portion of the collected liquid from the transmission means to the layer of structured packing.

20 14. A method for collecting and redistributing a flow of a liquid descending in an exchange column to a layer of structured packing disposed in the exchange column, the exchange column having a longitudinal axis, a cross-sectional area, and an inner wall having an inner perimeter, comprising the steps of:

25 introducing the liquid into the exchange column at a first location; positioning a layer of structured packing in the exchange column below the first location, the layer of structured packing having an exterior surface spaced apart from the inner perimeter of the inner wall;

30 positioning a wall-flow collector in the exchange column above the layer of structured packing and below the first location, the wall-flow collector having an outer perimeter adjacent the inner perimeter of the inner wall and being adapted to collect at least a portion of the liquid descending on or near the inner wall of the exchange column;

positioning a transmission means in the exchange column adjacent the wall-flow collector, the transmission means adapted to

transmit at least a portion of the collected liquid collected by the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column;

5                   collecting in the wall-flow collector at least a portion of the liquid descending on or near the inner wall; and

                  transmitting a substantial portion of the collected liquid collected in the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column;

10                  providing a dispensing means for dispensing at least a portion of the portion of the collected liquid from the transmission means to the layer of structured packing; and

                  dispensing the at least a portion of the portion of the collected liquid from the transmission means to the layer of structured packing.

15                  15.     A process for cryogenic air separation comprising contacting a flow of a descending liquid and a counter-current flow of an ascending vapor in at least one distillation column containing at least one mass transfer zone, wherein liquid-vapor contact is established by at least one layer of structured packing, and wherein at least a portion of the flow of the descending liquid is collected and redistributed to the structured  
20     packing by an apparatus as in claim 1.

                  16.     A method for assembling an apparatus for collecting and redistributing a flow of a liquid descending in an exchange column to a layer of structured packing in the exchange column, the exchange column having a longitudinal axis, a  
25     cross-sectional area, and an inner wall having an inner perimeter, comprising the steps of:

                  providing the exchange column;

                  providing the layer of structured packing in the exchange column, the layer of structured packing having an exterior surface spaced apart  
30     from the inner perimeter of the inner wall;

                  installing a wall-flow collector in the exchange column above the layer of structured packing, the wall-flow collector having an outer perimeter adjacent the inner perimeter of the inner wall and being adapted

to collect at least a portion of the liquid descending on or near the inner wall of the exchange column;

5            installing a transmission means in the exchange column for transmitting at least a portion of the collected liquid collected by the wall-flow collector toward the longitudinal axis a substantial distance across the cross-sectional area of the exchange column; and

10           installing a dispensing means for dispensing the at least a portion of the portion of the collected liquid from the transmission means to the layer of structured packing.

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